Appendix B

# Acquisition Strategy
# for
# The Center for Functional Nanomaterials

**Lead Program Office:**

**Office of Basic Energy Sciences**
**Office of Science**

**Total Project Cost Range: $70 - 85 million**

December 15, 2003
Revision 1

**CONCURRENCES:**

_____ Date: _____

Robert P. Gordon
Contracting Officer, DOE Brookhaven Area Office

_____ Date: _____

Joseph Eng
CFN Federal Project Director
DOE Brookhaven Area Office

_____ Date: _____

Michael D. Holland
Manager, DOE Brookhaven Area Office

_____ Date: _____

Kristin A. Bennett
CFN Program Manager, Office of Basic Energy Sciences
Office of Science

_____ Date: _____

Patricia M. Dehmer
Director, Office of Basic Energy Sciences
Office of Science

_____ Date: _____

Daniel R. Lehman
Director, Construction Management Support Division
Office of Science

_____ Date: _____

James A. Rispoli
Director, Office of Engineering and Construction
Management, (ME-90) / for
Office of Management, Budget and Evaluation

**APPROVED:**

_____ Date: _____

Raymond L. Orbach
Director, Office of Science

# Acquisition Strategy Change Log

| Revision No. | Date | Reason |
|---|---|---|
| 0 | June 2003 | Finalized for CD-1 |
| 1 | December 2003 | Updated for CD-2 |

# CENTER FOR FUNCTIONAL NANOMATERIALS (CFN)
# ACQUISITION STRATEGY

## 1. Desired Outcome and Requirements Definition

The mission of the DOE Office of Science (SC) is "To advance basic research and the instruments of science that are the foundations for DOE's applied missions, a base for U.S. technology innovation, and a source for remarkable insights into our physical and biological world and the nature of matter and energy." Within SC, the Basic Energy Sciences (BES) program's responsibilities include planning, constructing, and operating major scientific user facilities to serve researchers from universities, Federal laboratories, and industry.

Nanotechnology is the creation and use of materials, devices, and systems through the control of matter at the nanometer-length scale. It will fundamentally change the way materials and devices will be produced in the future.

Nanoscale Science Research Centers (NSRCs) were recommended by the National Science and Technology Council's Interagency Working Group on Nanoscale Science, Engineering and Technology as part of DOE's contribution to the National Nanotechnology Initiative (NNI). The NNI proposed significant increases in this Nation's investment in nanotechnology in order to ensure a competitive position in this rapidly developing field of science and technology. Europe and Japan are already heavily committed to this field of research, which promises to revolutionize technology in the 21st Century. The NSRCs will provide unique scientific and engineering capabilities not available in any of the parallel programs sponsored by other Government agencies. The Centers will become the cornerstone of the Nation's nanotechnology revolution, covering the full spectrum of nanomaterials and providing an invaluable resource for universities and industry.

In FY 2001, BES solicited proposals from the national laboratories for establishing several NSRCs. Following the completion of a scientific peer review process and vetting by DOE's Basic Energy Sciences Advisory Committee, five proposals were selected for further development. These five facilities will complement each other to comprise DOE's contribution to the NNI. Among the five proposals was one from Brookhaven National Laboratory (BNL) for the Center for Functional Nanomaterials (CFN). Critical Decision 0 (CD-0) for CFN was approved by Under Secretary Robert Card on June 12, 2002, thereby authorizing the start of Conceptual Design. There have been no material changes to CFN's scientific mission or project scope since that time, and the cost estimate has remained within the range ($70 – 85 million) approved at CD-0. CD-1, Approve Alternative Selection & Cost Range was received on July 23, 2003 and Title I, Preliminary Design started on August 1, 2003.

For all five NSRC projects, a conscious decision was made to co-locate each one at a DOE laboratory with major existing scientific user facilities so as to maximize the overall scientific impact of the NSRCs. These existing facilities include, for example, the synchrotron radiation light source facilities, the neutron scattering facilities, and the

electron beam microscope centers. In the case of CFN, the National Synchrotron Light Source (NSLS), the Laser Electron Acceleration Facility (LEAF), and substantial advanced electron beam micro-characterization instrumentation are located at BNL. Thus, the CFN facility will integrate BNL's existing capabilities in its synchrotron characterization techniques, its LEAF electron source, and its growing electron imaging facilities with new materials synthesis, imaging, materials temporal probes, and nanofabrication capabilities.

The scientific goal of the CFN is to understand the chemical and physical response of nanomaterials, with the challenge being to attain the level of understanding needed to tailor or design new classes of functional materials. The CFN's programs will exploit the unique electronic and optical properties of nanoparticles and molecular nanoarrays to design chemical systems with specific functionality for diverse, energy-related applications such as catalysis, photo-induced energy conversion and storage, and molecular conductors. Another science emphasis will be to examine the behavior and fundamental properties of functional nanocomposite materials including ferro-electrics, and magnetic and superconducting thin films to provide insights into their future applications. This capability and focus are complementary to the other planned NSRCs; it capitalizes on the NSLS leadership in new materials probes; and it builds on the strengths of BNL's BES programs in (1) strongly correlated electron systems, (2) catalysis, (3) molecular materials, (4) electrochemistry, and (5) nanostructure in complex functional materials.

The scope of this project includes design and construction of the CFN building, and procurement and installation of an initial set of specialized scientific equipment needed to support research activities. The physical structure of the Center will be a new building of about 94,500 gross square feet (gsf) located across the street from the existing NSLS. The CFN structure will be a two- story building housing state-of-the-art clean rooms; wet and dry laboratories for sample preparation, fabrication, and analysis; office space for BNL staff and users; and conference rooms. Elimination of space to offset this new construction will be accomplished by SC-funded demolition of excess facilities at BNL scheduled for FY 2002 through 2006.

The CFN building will incorporate human factors into its design so as to encourage peer interactions and collaborative visits by internal and external users. In addition to offices and laboratories, it will house "interaction areas" for informal discussions and scientific discourse. The clean rooms require special design features to address vibration isolation of sensitive equipment, shielding from electromagnetic (EM) forces, and sensitive temperature control. The specialized scientific equipment will provide capabilities for computation, synthesis, and sophisticated probes for characterizing new materials, e.g., catalysts, dielectrics, and organics.

The CFN will operate through major laboratory clusters: including facilities for lithography-based nanofabrication, scanning probe and surface characterization, electron microscopy, materials synthesis and fabrication, ultrafast optical sources, theory and computation, and beamlines at the NSLS. An initial set of scientific equipment for these laboratories will be purchased as part of the project.

## 2. Cost and Schedule Range

As stated in the CFN Mission Need Statement, this project has a preliminary Total Project Cost (TPC) range of $70 - $85 million. The preliminary TPC was further refined in the CFN Conceptual Design Report (March 2003) to $81.0 million. The major elements are:

| Component | Preliminary Estimate ($ in millions) |
|---|---|
| Title I, II, II Design and Management | 8.5 |
| Conventional Construction | 32.3 |
| Technical Equipment (incl install & test) | 26.5 |
| Standard Equipment | 0.9 |
| Other Project Costs | 1.3 |
| Contingency | 11.5 |
| Preliminary TPC | 81.0 |

For this stage of the project, there is reasonable confidence in this preliminary estimate because it was developed using a bottoms-up approach as part of the conceptual design process. The construction cost estimate is based on conceptual bills-of-materials prepared for each discipline as applied to R. S. Means estimating guide and BNL construction experience. Labor and material pricing is based on actual experience for construction in the Long Island, NY area. Major material items are based on vendor quotes. The estimate for special equipment is based on vendor quotes for each item and estimates for in-house labor to support procurement and installation.

The Architect-Engineer (A/E) contractor will be required to design a building of about 94,500 gsf to meet a target construction cost of about $31-32 million. Standard FAR clauses requiring "Design Within Funding Limitations" and "Responsibility of the A/E" will be included in the A/E subcontract to limit design costs.

Although the total life-cycle cost has yet to be determined, it is possible to identify the components. They are: (1) Capital Cost (TPC of $70 – 85 million); (2) Lifetime Operating Cost; (3) Scientific Equipment Upgrade Costs; (4) Decommissioning Costs. The estimated life expectancy of the building is 40 years, while the operating lifetime for each piece of equipment in the building will vary and be determined at the time of purchase. The Annual Facility Operating Cost is estimated to be about $18 million (in FY 2007 dollars; exclusive of costs associated with the various research programs [research equipment and research staff]). It is anticipated that additional scientific equipment (i.e., upgrades) will be procured during this 40-year period, but the magnitude is modest and uncertain. Lastly, there are no radiation concerns or unusual decontamination requirements/costs associated with the CFN, so decommissioning costs should be comparable to dismantling any other lab/office building of equal size. No further lifecycle cost analysis has been performed at this point because it would have no bearing on choosing among alternatives such as renovating an existing building or leasing a commercial facility. For CFN, these alternatives do not exist.

The CFN project will be entirely funded by BES; there are no inter-agency funding agreements or external sources of funding. The preliminary funding profile indicated below is based on conceptual design:

| Year | Budget Authority ($ in Millions) |
|---|---|
| Prior Years | 0.3 |
| FY 2003 | 1.0 |
| FY 2004 | 3.0 |
| FY 2005 | 20.5 |
| FY 2006 | 36.5 |
| FY 2007 | 19.2 |
| FY 2008 | 0.5 |
| Total Project Cost Range | $70-$85 |

While DOE did not request it, Congress provided the CFN project with about $1 million of Project Engineering and Design (PED) funding in FY 2003.

Although this project does not have a single procurement with a detailed, special form of cost analysis as identified in Federal Acquisition Regulation 15.407-4, an extensive amount of "should cost" methodology will be employed in preparing the estimates. The baseline TPC will be developed as a bottoms-up detailed estimate using nationally recognized estimating guide methodology (R.S. Means), supplemented by vendor quotes and BNL construction experience on recent projects. As a result, the TPC will serve as the "should cost" benchmark as the project evolves.

The CFN facility design is planned to start in late FY 2003 and should be completed in FY 2004. Bid and award of the general construction contract for the facility would follow in FY 2005. Major equipment procurements will start in FY 2005 and continue into FY 2007, with installation activities being accomplished by a combination of vendors supplying the equipment and BNL technical staff. Completion of the CFN project is envisioned to occur in 2007 – 2008.

The following list is a preliminary schedule of key milestone dates for the CFN.

| Schedule | Fiscal Year(s) |
|---|---|
| Title I & II Design | 2003-04 |
| DOE CD-2 (Performance Baseline) Approval | 3rd Qtr 2004 |
| DOE CD-3 (Start Construction) Approval | 1st Qtr 2005 |
| Procure Technical Equipment | 2005-07 |
| General Building Construction | 2005-07 |
| Install and Startup Equipment | 2007-08 |
| DOE CD-4a (Start of Initial Operations) Approval | 2007 |
| DOE CD-4b (Start of Full Operations) Approval | 2008 |

## 3. Major Applicable Conditions

There are no significant requirements for compatibility with existing systems or unusual cost, schedule, and performance constraints associated with CFN. Likewise, there are no unusual regulatory factors or political sensitivities that would affect the operational, design, or execution requirements of this project. Standard design and construction methods will be used to provide economical results. All work done on the CFN will be in accordance with applicable Federal, state and local guidelines for environmental objectives. An Environmental Evaluation Notification Form was prepared and has resulted in a Categorical Exclusion under the National Environmental Policy Act (NEPA).

## 4. Risk and Alternatives (Technical, Location, and Acquisition Approach)

The alternatives considered include modification or renovation of existing facilities at BNL, and building a new facility at BNL. Given that the CFN facility, like all of the other DOE NSRCs, requires clean room space with temperature control, vibration isolation, and EM shielding, it was determined that no existing BNL facilities would be suitable for modification. Thus, the only alternative analyzed in detail was that of building a new facility. This analysis, described below, leads to the conclusion that the proposed CFN project is relatively low risk.

Cost and Schedule Range: The CFN project is judged to be low risk in terms of completing the project on schedule and within budget (as described in section 2). The conventional construction is straightforward, and the technical equipment will be ordered from commercial vendors (no need for research and development). Adequate cost and schedule contingencies will be included in the Performance Baselines.

Funding Range and Budget Management: No unusual risks are foreseen in providing adequate funding for CFN. Congressional support for the NSRCs has been strong thus far, so annual appropriations are expected to meet the requested levels. The project's funding needs have been included in SC's outyear funding plans. Headquarters budget management will be handled by the CFN Program Manager in BES, with assistance from the SC Financial Management Division. All funding for CFN is under the direct control of the Acquisition Executive (Director, BES).

Technology and Engineering: As previously mentioned, the design and construction of the building are straightforward. The laboratory/office building will house clean rooms and scientific equipment that rely on proven technology. The instruments are commercially available (many are off-the-shelf and some will be built to customized specifications). The technical risks are low, and there is no research and development effort associated with the CFN.

Interfaces and Integration Requirements: The project will receive program guidance and funding from BES. The Associate Director for BES will serve as the CFN Acquisition Executive. A Federal Project Director at the DOE Brookhaven Area Office will carry out implementation and project management under the auspices of the DOE Chicago Operations Office. BNL has assigned a CFN Project Manager who will manage the project. The project has been integrated with site activities at BNL through the

establishment of an Integrated Project Team that includes members from the scientific staff, operations, facilities management, project management, and other organizations that will be affected by the project (see section 6). No unusual risks have been identified with regard to interfaces and integration.

Safeguards and Security: Normal BNL security requirements will be applied to CFN design and construction activity. CFN project activities will create no new security issues during design and construction. No laboratory safeguards and security requirements will need to be changed for operations. The facility is expected to be a low-hazard, non-nuclear facility. Access to and from the job site will be controlled by BNL security forces and the BNL Contractor/Vendor management system which includes minimum training requirements, card reader access systems and a contractor database to monitor contractor egress and debarment status. None of the work at the CFN is classified.

Location and Site Conditions: The proposed location of the CFN within the BNL site is ideal because it is:

- In close proximity to key staff and facilities (i.e., the NSLS and the Materials Science, Chemistry and Physics research buildings).
- In close proximity to the existing user support infrastructure provided by the NSLS.
- Compatible with all construction requirements.
- In conformance with BNL's Site-Wide Master Plan of 2000 and recent update in 2002 and planning assumptions of the Master Planning Steering Committee in 2003, and consistent with the BNL Institutional Plan for FY 2003 - FY 2007. (These plans comply with the Site Utilization and Management Plan identified in DOE Manual 413.3-1.)
- Environmentally sound.

Legal and Regulatory: The project will have no difficulty in fully complying with all applicable Federal, state and local requirements. Project activities will require typical construction permits. There are no known legal or regulatory issues that could impact the project.

Environment, Safety and Health: There are no operational constraints or safety, health and environmental issues that cannot be responsibly and economically addressed. An Environmental Evaluation Notification Form was prepared and has resulted in a Categorical Exclusion under NEPA. There should be no difficulty with obtaining modifications to the existing site air and ground discharge permits.

Stakeholder Issues: There are no significant stakeholder issues anticipated. Local and regional businesses and universities are strongly in favor of the CFN. Furthermore, BNL has good relations with the local community. Finally, New York State and local government officials are strongly in favor of the CFN and have voiced this support on numerous occasions. The BNL CFN will have a positive impact on the local economy. Through its existing outreach and community programs, BNL will keep stakeholders informed about initiation of and progress toward completion of the CFN project.

## 5. Business and Acquisition Approach

Certain tradeoffs were analyzed in arriving at the proposed acquisition strategy. At the most fundamental level it is more efficient to rely on the operating contractor, BNL, to act as the prime contractor for the CFN project rather than have DOE serve in that capacity. SC evaluated the option of handling the CFN acquisition itself, and found that it would be far more effective for the BNL M&O contractor to do the work. The main reasons for this choice are that:

- BNL has a vested interest in obtaining the best possible facility for the available funds.
- BNL will be the operator of this scientific user facility and their staff will actually be doing some of the research once it has been built. Hence, they must be directly involved throughout the design and construction process.
- Neither SC nor the Brookhaven Area Office have the staff (numbers of people or expertise) to oversee design and construction of the facility and handle all the procurements needed.
- BNL has a DOE-approved procurement system with established processes for handling A/E selection, construction management and equipment procurements.

Thus, BNL will have prime responsibility for oversight of all contracts required to execute this project. BNL has extensive experience at managing construction of research facilities of a complexity equal or greater than the proposed CFN. BNL's project management, construction management and ES&H management systems are all proven to be effective for oversight of projects of this scale and type. No Government Furnished Property will be involved in this project.

The CFN project will be accomplished using the design-bid-build method. Design-bid-build will provide BNL with more control of both the design and the construction activities by using an A/E firm separate from the construction contractor. In addition, BNL is more familiar with design-bid-build procurements on projects of this magnitude, so using design-build may impose undue risk due to unfamiliarity and procurement systems not already in place. CFN procurements fall into the following categories:

- Architect/Engineer Design Services
- Facility Construction
- Technical Equipment

Architect/Engineer Design Services: BNL will oversee conventional facility design performance by an A/E firm. The first major contract will be with a competitively selected A/E firm to provide design services and later assist in construction management and inspection. The selection of the A/E will consider technical qualifications in a best value process. The decision to use an A/E firm was based on the following:

- Sufficient BNL design staff cannot be dedicated to a project of this size without negatively impacting other construction programs
- A/E firms have more recent design experience with nanoscale research facilities

- Design by an A/E and associated construction management support are at a slightly higher cost than if performed by BNL but are required to meet schedule and technical objectives.

An A/E bidder's list is currently being developed; extensive interest has been expressed by many firms. BNL has established Basic Ordering Agreements with a number of full-service A/E firms qualified to provide design services for this project. Since experience with NSRC design is an important consideration, other A/E's will also be considered. Interested A/E firms will submit SF 244/254 forms for evaluation by a BNL selection committee appointed for that purpose. Twenty or more proposals are anticipated in response to the A/E solicitation. The selection process is expected to take approximately 3 months. The A/E contract will be cost plus fixed fee based on a defined scope of work. BNL has a success track record of obtaining A/E services under this type of contract.

Specifications and drawings will be developed by the A/E based on performance specifications provided by BNL. Specifically, the CFN Conceptual Design Report and the A/E services Scope of Work will be provided to the A/E to ensure that requirements for Title I and Title II design are clearly understood. This information contains the desired design estimates and construction cost objectives for the CFN. Value Engineering will be completed on the Title I design package by trained engineers and architects independent of the A/E contract for design services.

Facility Construction: Facility construction will be based on the detailed design specifications developed by the A/E. A complete set of design drawings and specifications will be provided to the GC to define the construction contract. Construction will utilize proven conventional methods with additional consideration given to structural requirements to isolate sources of vibration, architectural treatments to eliminate RF interference and HVAC systems to assure precise control of airflow, temperature and humidity in selected laboratories.

The Long Island / New York region has a large number of qualified general contractors capable of constructing this project. Interested bidders for the GC role will be solicited during the design phase to assure a competitive pool of contractors for the bid phase. Lump sum construction bids will be solicited from GCs in the New York / Long Island region. The value and scope of the project will attract a significant number of qualified bidders, insuring full and open competition. The bidding period for the GC contract is expected to take about 6 weeks with 2 weeks for award of contract. The GC contract will be awarded to using a best value process. Each bidder will be required to complete a Qualification Criteria form, including references and confirming data, and submit it with their bid. The qualification criteria will establish requirements for technical competency and safety performance on past projects.

Technical Equipment: BNL's research staff is best suited to specify, select and oversee procurement and installation of technical equipment. The selected equipment is expected to evolve as planning for the CFN scientific program continues with its future users at universities and in industry. These items will be procured from a variety of sources, depending on the item. In most cases, equipment will be competitively procured through

fixed price contracts. Some sole source fixed price procurements of one-of-a-kind equipment will be necessary in cases where only one qualified bidder exists. The project scope includes some large instruments with long lead times of 1-2 years.

Equipment specifications will be developed for each major procurement to define the performance and delivery requirements. Some of the large equipment will require installation and startup services as part of the original procurement. Contracts for installation of instruments will be incorporated in the instrument procurement contract where feasible and will be coordinated with the construction schedule to identify optimum delivery date for installation. Test and acceptance procedures for equipment will be defined in the individual procurement specifications for each item based on the needs of the specific laboratory and manufacturer's recommendations.

## 6. Management Structure and Approach

Integrated Project Team (IPT), Organizational Structure, and Staffing Skills:
The structure of the CFN project organization is illustrated in Figure 1. Key members of the IPT and their roles and responsibilities are described below. All members of the team participated in the development of this Acquisition Strategy. There is an appropriate mix of skills among the team members to successfully execute the CFN project.

Kristin Bennett, CFN Program Manager, DOE/BES. The BES Program Manager provides programmatic guidance for CFN via the Federal Project Director.

Joseph Eng, DOE BAO Federal Project Director. The Federal Project Director has overall responsibility for planning, implementing, and completing the CFN project. He will provide overall project management oversight, issue work authorizations, provide necessary funds via approved financial plans, submit key project documents and critical decisions to DOE, report project progress, and assess BNL project execution performance.

Robert Gordon, DOE BAO Contracting Officer. The Contracting Officer is responsible for administering the M&O contract with Brookhaven Science Associates for BNL and will monitor the M&O contractor's execution of the CFN project under the terms of DOE's contract with Brookhaven Science Associates.

Robert Hwang is the CFN Director. The CFN Director has the responsibility to continue to build participation and commitment from the outside research community as well as the construction of the CFN to accommodate the requirements of the researchers. He is responsible for the CFN user outreach programs and future transition to the operations of the new facility. The CFN Director reports to the DOE/BES through the Federal Project Director.

Mike Schaeffer, is the CFN Project Manager. He is directly responsible for implementing management methods required to achieve the CFN's specific project scope of work and execution of all activities required by this project to meet technical, schedule and cost objectives.

Martin Fallier, Conventional Construction Manager. Manager is responsible for execution of Conventional Construction including design of conventional facilities, construction management, site information, quality control during design and construction, design reviews, construction progress reviews, and final inspection, test and start-up.

Ove Dyling, Conventional Construction Design Manager. Responsible for design of conventional facilities, oversight of A/E services, Title I, II and III design and design support during construction.

Thomas Vogt/Arnold Moodenbaugh, are the Technical Equipment Coordinators. The Technical Equipment Coordinators are responsible for coordination and oversight of technical equipment activities including design of technical facilities, instrument specification, procurement, installation and testing of the equipment and instruments.

Paul Simons, Technical Procurement Manager. The Technical Procurement Manager has overall responsibility for source selection processes, requests for proposal and contract preparation, contract negotiation and overall contract administration.

Ken Koebel, Cost Control Manager. The Cost Control Manager is responsible for monitoring project cost and schedule performance, reporting and cost account management in accordance with DOE Manual 413.3-1.

Steve Hoey, BNL Project Environmental, Safety, Health and Quality Coordinator, (ESH&Q). The ESH&Q Coordinator is responsible for overall ESH&Q oversight of the project including environmental reviews and permitting, hazard analysis, design review for ESH&Q, and safety assessments during construction, testing and commissioning.

Additional support will be provided by BAO and BNL staff in the areas of ESH&Q; equipment procurement and inspection; budgeting and accounting; and overall quality assurance.

Approach to Performance Evaluation and Validation: Surveillance of the CFN work will be done at three basic levels:

First, the Federal Project Director will monitor and evaluate BNL project performance against technical, cost, and schedule baselines through monthly project reports, quarterly project performance reviews, and in-depth reviews. ESH&Q performance will also be monitored by conducting periodic field observations, using subject matter experts as necessary.

Second, BNL has overall project management responsibility, including monitoring the A/E and GC to ensure that design and construction work is proceeding as planned and providing procurement support, construction support services, and utility tie-ins. For earned value management, BNL intends to use Primavera.

Lastly, the General Contractor will have their monitoring systems in place to evaluate the progress of construction contracts in accordance with contract requirements.

Interdependencies and Interfaces: The CFN project is consistent with the BNL scientific mission and the facility is included in their Site Master Plan. There are no functional interdependencies with the other four NSRCs, however, the CFN project will benefit from certain synergistic aspects of building five NSRCs at roughly the same time (management lessons learned, etc.). The CFN will capitalize on the presence of other major BES user facilities at BNL, namely NSLS and LEAF. As previously described, the CFN project involves organizational interfaces between BES, BAO, BNL, and BNL's subcontractors (A/E, GC, and equipment vendors).

# Figure 1
# Center for Functional Nanomaterials (CFN)
# Project Organization